REMARKS

Applicants respectfully request reconsideration of the present application in view of the foregoing amendments and in view of the reasons that follow. Applicants respectfully request that the foregoing amendments be entered, because they merely incorporate features of a dependent claim (claim 6) into its independent claim (claim 1), and thus do not raise any new issues requiring further search or consideration.

Claim 1 has been amended to incorporate the features of dependent claim 6, which has been cancelled without prejudice or disclaimer. Support for this amendment can be found at least in original claim 6, and in the original specification on page 4, lines 12-19.

Rejections Under 35 U.S.C. § 112

Claims 1, 3 and 5-9 stand rejected under 35 U.S.C. § 112, first paragraph, as failing to comply with the written description requirement. Specifically, the Office Action stated on page 2: "The expressions 'at least some Ta' and 'at least some oxygen' in claim 1 do not have literal support from the specification as originally filed."

Applicants submit that the expressions "at least some Ta" and "at least some oxygen" in claim 1 are fully supported by the application as originally filed. Both Ta and oxygen are inherently contained as inevitable impurities in a Nb sputtering target, and one of ordinary skill in the art would recognize as much based on the disclosure as originally filed. As noted in the Declaration by one of the inventors, Koichi Wantanabe, under 37 C.F.R. 1.132 filed in the present application on April 12, 2004, JP 62-103335 demonstrates that oxygen exists as an impurity in Nb even for super high purity Nb produced by high quality manufacturing methods. Moreover, all the examples disclosed in the present application for the oxygen effect study (see Table 3 on page 25) exhibit at least some oxygen.

One of ordinary skill in the art would also recognize that Ta is an inevitable impurity based on the close connection between Ta and oxygen, i.e., the coexistence of Ta and oxygen in a high purity Nb sputtering target. For example, in the specification from page 4, line 25 to page 5, line 19, it is disclosed that oxygen as an impurity is closely related with an oxide of Ta (Ta_2O_5). One of ordinary skill in the art would find that the expressions "at least some Ta"

and "at least some oxygen" in claim 1 are fully supported in the specification as originally filed.

Moreover, the test for written description support is not express disclosure in the specification, but whether one of ordinary skill in the art would recognize the inventor to be in possession of the invention as claimed. In the present case, based on the discussion above that Ta and oxygen are inevitable impurities in a Nb sputtering target, one of ordinary skill in the art would understand that the high purity Nb sputtering target of claim 1 must contain at least some Ta and at least some oxygen.

Claims 1, 3 and 5-9 stand rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicants regard as the invention. Specifically, the Office Action stated on page 2: "Claim 1 is indefinite because the wording 'some' in lines 3 and 4 fails to define [a] specific amount."

The term "some" in lines 3 and 4 of claim 1, is definite in that the term merely conveys an existence of an amount greater than zero. The wording "at least some amount" clearly and definitely expresses the existence of the impurities Ta and oxygen in an amount greater than zero. In view of the forgoing comments, applicants respectfully request that the rejections under 35 U.S.C. 112, paragraphs 1 and 2 be withdrawn.

Rejections Under 35 U.S.C. § 103

Claims 1, 3, 5-10, 12, 14-18 and 20-23 stand rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 5,693,203 to Ohhashi et al. (hereafter "Ohhashi") in view of applicants' alleged admission in the Rule 132 declaration filed on April 12, 2004. Claims 24-25 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Ohhashi in view of acknowledged prior art on page 2, lines 1-24 (hereafter "the APA"). Applicants respectfully traverse these rejections for at least the following reasons.

Claims 1 and 18

Claims 1 and 18 are each directed to a high purity Nb sputtering target. Claim 1 recites an amount of Ta less than 3000 ppm, a Ta content dispersion within 30%, an amount of oxygen less than 200 ppm, and an oxygen content dispersion within 80%, while claim 18 recites an amount of oxygen less than 200 ppm and an oxygen content dispersion within 80%.

The claimed amount and dispersion is not disclosed in Ohhashi, nor is it inherent.

Ohhashi does not suggest a Nb sputtering target with the Ta amount, Ta dispersion, oxygen amount or oxygen dispersion of claim 1, or the oxygen amount or dispersion of claim 18. Ohhashi does not deal with the existence of Ta or oxygen in a Nb target nor does Ohhashi recognize the problems caused thereby, much less the specific amounts and dispersion characteristics recited in claims 1 and 18. In the Ohhashi disclosure, Nb is merely enumerated as one of various metal materials for sputtering targets. Ohhashi does not disclose any specific examples relating to a Nb target, instead, Ohhashi discloses a high purity tungsten sputtering target (example 5) and a high purity titanium sputtering target (example 6). Ohhashi, which merely provides specific examples of W or Ti sputtering targets, does not recognize the above problem in a Nb sputtering target, and does not suggest any specific amounts or dispersion of Ta or oxygen in a Nb sputtering target.

Moreover, Ohhashi's disclosure of a uniform microstructure for the grains of his sputtering target with little diffusion for the atoms of the grains does not suggest what the amount or dispersion may be for Ta or oxygen impurities in a Nb sputtering target. A uniform dispersion merely means that the dispersion is constant, not that the dispersion is zero.

The recited amount and dispersion levels of Ta and oxygen in claims 1 and 18 are not inherent in Ohhashi. In the present case, the Patent Office has not met its burden of showing that the amount and dispersion levels of the inevitable impurities Ta and oxygen recited in claims 1 and 18 are necessarily present in the Nb sputtering target disclosed in Ohhashi. To the contrary, applicants have shown that the Ta and oxygen amounts and dispersion recited in claims 1 and 18 are not inherent in Nb sputtering targets. Applicants provide, as evidence that proves lack of inherency, examples from the present specification which disclose some Nb sputtering targets having Ta and oxygen with amounts and dispersion outside the range recited in claim 1 and 18.

Moreover, the Patent Office has provided no evidence that the distribution of the inevitable impurities Ta and oxygen in a Nb sputtering target would be uniform, such that the dispersion % of these impurities are zero. To the contrary, the many examples of non-zero dispersion % in the present specification clearly suggests that a zero dispersion % of oxygen and Ta in Nb sputtering targets is not inherent. Merely because an element is an impurity

does not suggest that it has a uniform distribution. If the Examiner maintains this contention, applicants respectfully request the Examiner to provide evidence supporting his contention.

The burden is upon the Patent Office to reasonably establish inherency, which the Patent Office has not done. Moreover, to the extent that the Patent Office can arguendo be considered to have raised a reasonable doubt as to whether Ohhashi may inherently disclose a uniform dispersion of these impurities, as discussed above, applicants have shown by evidence that the amount and dispersion levels of Ta and oxygen claimed are not inherent in Nb sputtering targets.

Further, the Examiner has provided no evidence or scientific basis to disqualify the objective evidence that Applicants have submitted establishing that the amount and dispersion levels of Ta and oxygen claimed are not inherent in Nb sputtering targets. If the Examiner maintains this rejection, the Examiner is respectfully requested to provide objective evidence and/or a scientific basis establishing that the amount and dispersion levels of Ta and oxygen claimed are inherent in Nb sputtering targets.

The claimed amounts and dispersion are not obvious in view of Ohhashi

The Ta and oxygen amounts and dispersion recited in claims 1 and 18 are not obvious in view of Ohhashi, in view of the fact that Ohhashi does not suggest that the Ta and oxygen amounts and dispersion are result effective variables for his Nb sputtering target. A particular parameter must first be recognized as a result-effective variable in order to show that a claimed range would have been obvious. See MPEP 2144.05 II B. In the present case, Ohhashi does not even recognize the existence of inevitable Ta or oxygen impurities in a Nb sputtering target, much less that such parameters are result effective variables. Thus, the recited Ta and oxygen amounts and dispersion in claims 1 and 18 are not obvious over Ohhashi for at least this reason.

Claims 1 and 18 are further seen to be patentable over Ohhashi in view of the advantages of the invention as claimed. Ohhashi fails to suggest these advantages, or to even recognize the parameters that are important in attaining these advantages. The inventors have determined important parameters in solving resistivity problems of Nb liner films for Al films. The present inventors have realized that merely decreasing the Ta or oxygen content alone does not decrease the resistivity of the entire Nb film with reproducibility. The

inventors have found that, in high purity sputtering targets, the dispersion and content of Ta in the Nb target, and the dispersion and content of oxygen in the Nb target, are important parameters. These parameters are implemented in the sputtering targets of independent claims 1 and 18, which recite, respectively, the content and dispersion of Ta and the content and dispersion of oxygen, and the content and dispersion of oxygen which provide an improved Nb sputtering target. By suppressing the dispersion of Ta or oxygen in the Nb target, while at the same time decreasing the content of Ta or oxygen in the Nb target, it becomes possible to decrease the resistivity of the entire Nb wiring film, such as a film formed as a liner for an Al wiring film, when that film is formed using the sputtering target.

The beneficial effect of suppressing the dispersion of Ta or oxygen in the target to within the levels recited in claims 1 and 18 is demonstrated in the present specification, as noted throughout the prosecution of this application. Ohhashi completely fails to recognize or teach this key relationship that is the basis for the present invention directed to a Nb sputtering target, and consequently the reference does not and cannot render the present invention "obvious".

Claim 10

Claim 10 is directed to a Nb sputtering target and recites an average grain diameter of 100μm or less, a grain diameter in the range of 0.5 to 5 times an average grain diameter, and a dispersion of the grain size ratio of adjacent grains within 30%. Ohashi fails to disclose the average grain diameter, diameter range, or dispersion as recited in claim 10, or its advantages in suppressing giant dust particles, as recognized by the present inventors.

Ohhashi merely discloses a sputtering target having uniform microstructure and crystal orientations with crystal grain sizes of no more than 350 μm. Nowhere, however, does Ohhashi disclose the average grain diameter, diameter range, or dispersion as recited in claim 10. Ohhashi also fails to teach or suggest suppressing the occurrence of giant dust particles by controlling the grain size ratio of adjacent grains to be in the range of 0.5 to 5 and the dispersion of the grain size ratio of adjacent grains to be within 30%. Ohhashi does not recognize that the average grain size is important in reducing dust, nor does Ohhashi disclose the specific average grain size recited in claim 10. Ohhashi merely discloses a crystal grain size of no more than 350 μm.

Independent claim 1, as amended, recites "wherein each grain of Nb has a grain diameter in the range of 0.1 to 10 times an average grain diameter, and a grain size ratio of adjacent grains is in the range of 0.1 to 10", and arguments regarding this feature in claim 11, apply equally well to claim 1.

The alleged APA also fails to suggest the parameters as recited in claims 1, 10 and 18, and thus fails to cure the deficiencies of Ohhashi. For at least the reasons given above, applicants respectfully submit that claims 1, 10 and 18 are patentable over Ohhashi and the APA. Independent claims 24 and 25 include similar Ta and oxygen parameter limitations to claims 1 and 18, respectively, and are thus patentable for at least those reasons. All dependent claims depend from one of claims 1, 10, and 18, and are patentable for at least the same reasons, as well as for her patentable features recited therein.

Applicants believe that the present application is now in condition for allowance. Favorable reconsideration of the application as amended is respectfully requested.

The Examiner is invited to contact the undersigned by telephone if it is felt that a telephone interview would advance the prosecution of the present application.

The Commissioner is hereby authorized to charge any additional fees which may be required regarding this application under 37 C.F.R. §§ 1.16-1.17, or credit any overpayment, to Deposit Account No. 19-0741. Should no proper payment be enclosed herewith, as by a check or credit card payment form being in the wrong amount, unsigned, post-dated, otherwise improper or informal or even entirely missing, the Commissioner is authorized to charge the unpaid amount to Deposit Account No. 19-0741. If any extensions of time are needed for timely acceptance of papers submitted herewith, Applicants hereby petition for such extension under 37 C.F.R. §1.136 and authorize payment of any such extensions fees to Deposit Account No. 19-0741.

Respectfully submitted,

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